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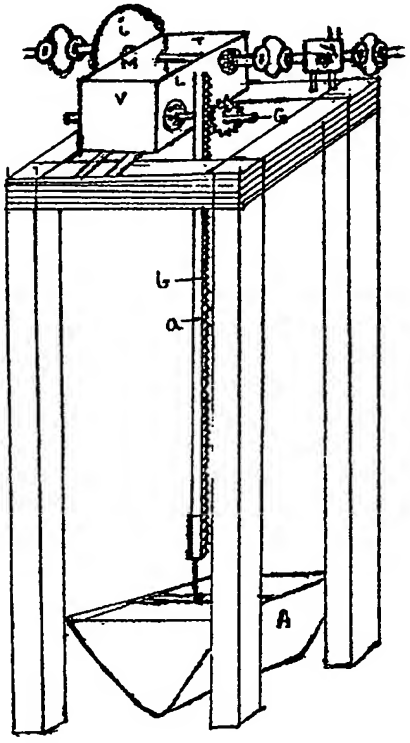
(54) Title: AN APPARATUS FOR POWER GENERATION FROM OCEAN TIDES / WAVE MOTION (SAGAR LEHAR VIDYUT SHAKTI)



(57) Abstract: Apparatus for power generation from ocean tides/waves to get electrical energy. The apparatus consists of several units, each unit has a float (A), which is guided by four pillars, two centrifugal pumps (E, F) to pump in or pump out water from the float (A), two counter weights (U) which are connected by two ropes to the float (A). The counter weights (U) slide in two railings (S, T) each mounted on either side of the four pillar structure. The up and down movement of the float (A) over the waves is transferred to a toothed rack (B) which moves a pinion gear (Z) of a turbine. The pinion gear (Z) is fixed to a horizontal shaft of a turbine. Three different types of turbines have been designed. Within each turbine are free-wheels, chain-loops (L) and gears so as to drive the shaft connecting the generator in one direction only as the float (A) moves up and down. For generating large amounts of power, a number of floats (A) are placed in a row.

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AN APPARATUS FOR POWER GENERATION FROM OCEAN TIDES / WAVE MOTION (SAGAR LEHAR VIDYUT SHAKTI).

The following specification particularly describes the nature of the invention and the manner in which it is to be performed.

This invention relates to an apparatus for power generation from ocean tides / Wave motion (Sagar Lehar Vidyut Shakti) for converting the kinetic energy present in the ocean tides / Waves into a rotational movement for getting electricity.

FIELD OF THE INVENTION:-

This Invention relates to power generation and more specifically to a novel and a new system of converting the Kinetic Energy present in the Ocean Tides / Waves into a rotational movement for getting Electricity.

BACKGROUND OF THE INVENTION:-

There have been concerns regarding the limited resources of conventional combustible hydrocarbon fuel sources and the damaging emissions that result from their use. This has prompted a great deal of research work into use of sustainable non-polluting energy sources, such as Tides/ Waves, Wind Geo-Thermal, Solar etc.

The waves are ultimately a product of Solar energy. Waves are one of the most concentrated and consistent sources of renewable energy. When compared to conventional fossil fuel generation, Wave energy offers the double benefits of near limitless free supply and a total lack of environmentally polluting emissions.

Although the total amount of wave energy of the oceans is of immense proportions, each individual wave is of restricted length and of short duration and its energy content is little. Hence the successful utilization of wave energy needs solution of three problems. The first is the problem of capturing the energy of the waves and transferring it to installed machines. The second and more important problem is the consolidation of the energy of successive waves arising in a place. The third and most important is the consolidation of the energy of waves over a long distance of the coast.

There is also a need to develop a simple system which has minimum parts and require minimum maintenance.

DESCRIPTION OF THE PRIOR ART

A number of different types of power generation systems have been proposed for commercial electrical generation.
There are three basic systems for wave energy conversion.

1. Surge or Focussing devices that channel the Ocean waves into Reservoirs.
2. Surface followers that use floats or pitching devices that drive hydraulic pumps. And,
3. Oscillating water column systems that use the waves to compress air within a container.

The mechanical power created from these systems either directly run a generator or transfer to a working fluid – Water or air which then drives a Turbine – Generator. The main deficiencies with wave driven air Turbine systems, is the restricted overall achievable energy efficiencies. This is primarily due to the limitations, firstly in the means of focusing the wave energy to maximum the wave displacement amplitude and secondly deficiencies inherent in the turbine designs.

A number of prior art wave energy focusing devices have relied on planer reflection of the wave front and / or the wave front is channeled through a narrow opening so that the vertical displacement or amplitude of the wave is magnified. Some other focusing devices have various means to change the formation of the seabed. This disrupts the wave propagation and the amplitude of the wave is maximized at a predetermined location.

In the surface followers that use floats or pitching devices, the floats or pitching devices are connected to ropes or cables and these in turn are connected to either to pumps or to ratchet mechanisms so as to turn electrical generators when the floats are either rising or falling.

Also, the floats may drive hydraulic pumps or pistons and this kinetic energy is used to drive a turbine. Ex. Sea Power and Associates' wave Rider.

Underwater turbines capture the movement of the Ocean's currents and use this energy to drive slow moving blades. These in turn, power a generator like an under water wind will. Example:- Blue energy's Davis Hydro Turbine.

Those devices having pulleys and cables near or below the water surface and connected to floats or paddles are subjected to the destructive and corrosive power, which sand and salt water have. Continued back and forth motion of a

cable through a pulley in an under water environment will require frequent maintenance which may be very closely.

All these above involves a lot of expenditure. The object of the present invention is to overcome all the disadvantages of the prior art and be a useful alternative thereof.

In the present invention, the vertical movement of the waves is translated into a rotatory movement, so as to directly or indirectly drive a generator. In each unit of this invention, only a small height of the four pillars and the lower surface of the float are in contact with the sea water. Rest of all the equipment is above the water, thus over coming a number of problems seen in the prior art. The pillars that are in contact with the ocean water and the parts of the float that are in contact with the ocean water, only require regular maintenance.

This ocean wave energy conversion system is competitive with fossil fuels and is useful in large number of coastal areas throughout the world all through the year.

OBJECTIVES OF THE INVENTION

The objects of this invention is to provide an apparatus for harnessing the ocean wave energy efficiently.

Another object of the invention is to construct the power generating system in the most appropriate location to maximize the effect of the ocean waves.

One more object of the invention is to set up a power generating system expeditiously and economically.

Furthermore, another object of the invention is to place all the generating systems out of the water much above the ocean surface.

Further, the novel feature of this invention, the object and advantages will be known, in part in the following detailed description and in part will become apparent upon examination by those skilled in the art or through practice of the invention.

The ocean and energy conversion system has a low initial investment cost, can be easily expandable to meet the rising demand for energy and also requires minimal maintenance.

Further more, the objects and advantages of this invention will become apparent from the following description and the accompanying annexed drawings.

BRIEF DESCRIPTION OF THE ACCOMPANYING DRAWINGS

Fig 1 : Aerial view of the pillars and the floats A – Pillars, B – Floats, C – Sliding Wheels

Fig 2 : View of the frame that slides on the pillars

Fig 3 : Lateral view of a float with upper 'a' and lower 'b' frames, centrifugal pumps (E & F) and hydraulic jack 'a' in place.

Fig 4 : Hydraulic jack E, rod C and bar with gear teeth D.

Fig 5 : Inside view of the arrangement of the gears inside the turbine type 1. K & J free-wheels

Fig 6 : View of the side plates of the turbine type 1.

Fig 7 : Top view of the turbine type 2. AB compartments, CD toothed wheels, EF free-wheels, 'c' 'b' 'a' 'e' 'f' gear wheels 'z' pinion gear. 'i' flywheel, HGJIK shafts. L chain loops.

Fig 8 : Various plates X, Y, Z, P, Q, R of which the turbine type 2 is made of

Fig 9 : Top view of the turbine type 3. CD toothed wheels, EF free-wheels, 'e' 'f' gear wheels 'i' fly-wheel 'z' pinion gear. L chain loops, HGK shafts.

Fig 10: Various Plates X,Y, P,Q, R of which the turbine type 2 is made out.

Fig 11: Front view of the gear box with pinion gear 'z', engaging rod with bar gear teeth 'a' 'b'.

Fig 12: Side view of the turbine and mechanism to hold the rod having gear teeth 'a' 'b' engaging the pinion gear 'z'.

Fig 13: Aerial view of the mechanism to hold the rod having bar gear teeth 'a' 'b' engaging the pinion gear 'z'

Fig 14 : View of the turbine, fly wheel 'i', generator 'l' and compressor 'n'.

Fig 15 : View of the fly-wheel 'i', pulley grooves 'j' 'k' and the break system 'w'

Fig 16 : Side view of the pillars, the float A, the hydraulic jack, with the bar

of gear teeth 'a' 'b', the pinion gear 'z', the turbine, the fly wheel 'i' and the motor 'm' powering the compressor

Fig 17: Front view of the pillars with float A, sliding frames ST, counter weight U, pulleys P, rope R.

Fig 18: Sliding frames ST, counter weight U.

Fig 19: Counter weight U, pulleys P, rope R, float A.

Fig 20: Front view of the pillars P, with the floats A, the hydraulic jacks E and the rods C with the bar gear teeth.

Fig 21: Aerial view of all the units connected to the horizontal shaft, which is connected to a generator.

BRIEF DESCRIPTION OF THE INVENTION

Oscillating wave energy moves a float placed and guided between four vertical pillars standing on the seabed. Each float has one or two counter weights of about one-third of the total weight of the float, and sliding along the railings on one or two sides of the four pillared structure. A hydraulic jack from the upper surface of the float connect to a vertical rod. This vertical rod has a side with gear teeth which engages a pinion gear mounted on the horizontal shaft of a turbine. Three different types of turbines have been designed. Within each turbine are free-wheels, chain loops and gears so as to drive the shaft connecting the generator in one direction only as the float moves up or down. For generating large amounts of power, a number of floats are placed in a row. Many rows are placed side by side along the coast. Finally power of all the rows is transferred to a long horizontal shaft which drives a generator. There are a number of arrangements to regulate the speed of the generator to get grid quality power.

DETAILED DESCRIPTION OF THE INVENTION

The apparatus for power generation from ocean tide / wave motion (Sagar Lehar, Vidhyut Shakthi), is a system for harnessing the energy of ocean tides / waves to produce useful energy like electricity. This consists of a number of floats. (See Fig.3). Each float along with its gear system may be considered as a unit. A single unit is being described. Each float is guided between four pillars. (Fig. 1-A), built on the sea bed in 3 feet to 10 feet or more depth of the sea near to the shore. Each float has arrangement to pump in or pump out water from it (See Fig. 3 –E&F). The inner shaft of a vertically placed hydraulic jack (Fig. 3-G) is connected to the gravitational center of the float. The other end of the hydraulic jack is connected to a rod (Fig 4-C). The rod has on one side a bar with gear teeth (Fig 4 –D). The gear teeth of the bar engages a pinion gear on a horizontal shaft which is placed in the same direction as the waves incident on the float. (Fig 12-Z, G)

Type 1 turbine

(See Fig 5) The horizontal shaft say first shaft H has two free-wheels placed on the shaft in reverse directions, so that in which ever direction the shaft H is rotated, its gets engaged. Gears of the same size are mounted on each free wheel. One free wheel gear (J) engages a wheel gear of the same size on a second shaft (C) . This second shaft I also has a second wheel gear which is unengaged (D).

The second free wheel gear (K) engages a wheel gear (F) of the same size of a third shaft (G). the third shaft (G) also has another unengaged wheel gear (E). The two unengaged wheel gears (D) & (E) on the second and third shafts engage each other as shown by arrows in fig. 5. The sizes of the wheel gears on the three shafts may also be such that they engage one another and all the three shafts moving on ball bearings, move in unison. All the three shafts (Fig 12 – H GI with their wheel gears placed in a box and are lubricated by gear oil.

Thus in whichever direction, the first shaft (H) having the free wheels is moved, the second and third shafts move in only one direction.

When a number of units are there, one behind the other in a row, the second shaft connects with the corresponding 2nd shaft of the next unit behind or the third shaft connects with the corresponding third shaft of the next unit behind. Here , the same incident wave after lifting the first float, lifts the 2nd float behind and the third float behind etc., till all its energy is used in lifting the floats. The floats may be placed one immediately behind the other or at some distance between them. A number of rows of floats or units may be placed side by side along the length of the coast.

Type 2 Turbine

The turbine (See fig 7) has two compartments (say A & B) The horizontal shaft (H) has two sets (Say C & D) of toothed wheels. The two sets of toothed wheels occupy one compartment each. The toothed wheels in a set may be of the same size or of different sizes.

In compartment A, there is a shaft (I) on which a set of free-wheels (Say E), all placed in the same direction of movement are present. The set of toothed wheels (C) on shaft H move the set of free-wheels (E) on shaft I, by chain loops L. The shaft I has a gear 'a' which moves the gear 'b' on shaft J which in turn moves the gear 'c' on shaft G.

In compartment B, there is a shaft (Say K) on which are a set of free-wheels (Say F) all placed in the same direction (But in opposite direction to the free-wheels E on the shaft I in compartment A) chain loops L connect and move the toothed wheels D on shaft H and the free-wheels F on shaft K. There is a gear 'e' on the shaft K which moves the gear 'f' on shaft G. The fly wheel 'i' is placed on shaft G. The shaft G is also connected outside the turbine to a motor (See fig 14-y) which runs on a compressor to move the shaft in the same direction as that of its rotation.

Type 3 Turbine

The horizontal shaft H has two set (Say C & D) of toothed wheels. The toothed wheels in a set may be of the same size or of different sizes.

In the turbine, there is another shaft G on which are a set of free-wheels (Say E) all placed in the same direction of movement. The set of toothed wheels C on shaft H moves the set of free-wheels E on shaft G with chain loops.

In the turbine there is a third shaft K on which or a set of free wheels say F, all placed in the same direction of movement (But in opposite direction to the movement of the free-wheels E on the shaft G) The set of toothed wheels D on shaft H move the set of free-wheels F on shaft K through chain loops. The shaft K has a gear 'e' which moves the gear 'f' on shaft G. The fly wheel 'i' is placed on shaft G. The shaft G is also connected outside the turbine to a motor (See fig 14-y) which runs on a compressor to move the shaft in the same direction as that of its rotation.

(See Fig 14) On the second or third shaft is placed a fly wheel (i) and a motor (y) which runs on compressed air or fluid of a compressor (n), so as to turn the shaft in the same direction as that of its rotation. The fly wheel has a break system on it, (Fig 15 – X, Y) to slow its speed if needed. This break system is connected to the compressor tank (n). The fly – wheel also has two pulleys grooves on it to run pulley belts (Fig 14 – k, j). When only one unit is used to produce power, one pulley groove may be used through a pulley belt (p) and counter to get the required speed to run a generator (I). Alternately the generator (I) may also be run through a gear box 'o' (to get the required speed), which is connected, to the same shaft as that of the fly wheel.

The second pulley groove (k) on the fly wheel (I) is connected through a pulley belt to a motor 'm' which powers the compressor tank 'n'. The following - a) The break system on the fly – wheel connected to the compressor tank (n), - b) The compressor tank (n) powering the motor (y) on the shaft – c) The Hydraulic Jack connected to the compressor tank (n) and d) The adjustment of the water level in the float with centrifugal pumps (Fig.3 e,f) placed on the float and connected to the compressor tank (n) are all connected through a computer system or a mechanical system to co-ordinate and regulate the speed needed to run the generator.

(See Fig 21) The shaft of each last unit in a row towards the shore is connected to a long horizontal shaft placed at 90° (to the shafts) with 45° bevelled gears (b, c). Thus all the power of the rows of the units is transferred to the horizontally place shaft. This horizontal shaft is connected to an electric generator (G) through a gear box (E) if needed, to produce grid quality power.

Although the ocean wave energy conversion system and the method of using the same according to the present invention has been described in the

foregoing specification with considerable details, it is to be understood that modifications may be made to the invention which do not exceed the scope of the appended claims and modified forms of the present invention done by others skilled in the art to which invention pertains will be considered infringements of this invention, when those modified forms fall within claimed scope of this invention.

EXPERIMENTS

Experiment I was carried out on Machilipatnam Beach (A.P, India) in July 2000. Only one float was used in the experiment. Instead of the concrete pillars. MS channels were used to guide the float. A 1 KVA Generator of 1500 RPM was used. Three bulbs of 100 Watts were placed in series. The bulbs lighted only for a few minutes, as the equipment was not strong enough to withstand the forceful ocean waves.

Experiment 2 was carried out in November 2001 using prefabricated pillars made of concrete to withstand the force of the ocean waves. The result was almost similar as the gears in the gear – box did not withstand the force obtained there.

CLAIMS

I claim, an apparatus for harnessing the energy of ocean tides / waves to get useful electrical energy. This comprises of number of units.

1. Each unit has a float, which is guided by four pillars constructed from deep below the ocean bed. (See fig.16). Each float has on it, two centrifugal pumps to pump in or pump out water from the float so as to vary its weight (see fig.3) The float is connected on either side of its upper surface, to two counter weights of more or less nearly one - third (1/3) of the total weight of the float. The two counter weights are connected by two ropes to the float. The counter weights slide in two railings placed one each on either side of the four-pillared structure (Fig 17). The up and down movement of the float over the waves is transferred to a rod through a hydraulic jack. The rod has gear-teeth on it's side which moves a pinion gear of a turbine. The pinion gear is fixed to a horizontal shaft of a turbine (see fig.16). There are three types of turbines described here. Any one of them can be used in a unit.

Type 1 Turbine (See fig 5)

Here the horizontal shaft (H) has two free-wheels placed in reverse direction in the turbine. One free wheel engages one of the two gears on a second shaft. (I). The other free-wheel engages one of the two gears on a third shaft (G). The unengaged gears on the second and third shafts engage each other. (See Fig.5). All the three shafts run on ball-bearings. Either second or third shaft also has a fly-wheel outside the gear-box. The second or third shaft is also connected outside the gear box to a motor (see fig.14-y) which runs on a compressor to move the shaft in the same direction as that of its rotation.

Type 2 Turbine (See fig 7)

The rod with gear teeth on it's side moves a pinion gear 'z' on type 2 turbine. The pinion gear 'z' is on a horizontal shaft (Say H). This horizontal shaft (H) has two sets (Say C & D) of toothed wheels. The turbine has two compartments (Say A & B).The two sets of toothed wheels occupy one compartment each. The toothed wheels in a set may be of the same size or of different sizes.

In compartment A there is a shaft I on which a set of free wheels (Say E) all placed in the same direction of movement are present. The set of toothed wheels (C) on shaft H move the set of freewheels E on shaft I through chain loops. The shaft I has a gear 'a' which moves the gear 'b' on shaft J which in turn moves the gear 'c' on shaft G.

In compartment B, there is a shaft (say K) on which are a set of freewheels (Say E) all placed in the same direction (But in opposite direction to the movement of the freewheels E on the shaft I in the compartment A). Chain loops connect and move the toothed wheels D on shaft H and the freewheels on shaft K. There is a gear 'e' on shaft A which moves the gear 'f' on shaft G. The fly wheel 'i' is placed on shaft G.

Type 3 Turbine (Fig 9)

The rod with the gear teeth on its side moves a pinion gear 'z' on type 3 turbine. The pinion gear 'z' is on a horizontal shaft (Say H). This horizontal shaft H has two sets (Say C & D) of toothed wheels. The toothed wheels in a set may of the same size or of different sizes.

In the turbine there is another shaft G on which are a set of free-wheels (Say E) all placed in the same direction of movement. The set of toothed wheels C on shaft H moves the set of free-wheels E on shaft G with chain loops.

In the turbine, there is a third shaft K on which are a set of free-wheels (Say F) all placed in the same direction (But in opposite direction to the movement of free-wheels E on the shaft G). The set of toothed wheels D on shaft H move the set of free wheels F on shaft K through chain loops. The shaft K has a gear 'e' which moves the gear 'f' on shaft G. The fly wheel 'i' is placed on shaft G.

The fly-wheel has a break system to slow its speed if needed. (See fig 15). The fly wheel also has two grooves on it. When only one float movement is used for power generation, the fly-wheel rotates a generator by a pulley belt placed in one of its grooves. Alternatively, the second or third shaft of the type 1 turbine or shaft H of the second or third turbine rotates a generator through a gearbox to get the required speed. The second groove on the flywheel is used to power a compressor with a pulley belt (See fig 14 mn). The compressor through a computer system or a mechanical regulating system powers.

a. The motor on the second or third shaft of type 1 turbine or shaft H of type 2 or Type 3 turbine.
b. The break system of the flywheel.
c. The centrifugal pumps on the float and,
d. The hydraulic jack.

When a number of units are used for power generation, the power of one unit is transferred to the unit behind in a row, by connecting the corresponding second or third shaft to one another in type 1 turbines or shafts H of type 2 turbines or shafts H of type 3 turbines. The power of a number of rows is

transferred to a long horizontal shaft placed at right angles to the rows, by 45° spiral beveled gears. (See fig 21)

The horizontal shaft rotates a generator through a gear-box, if needed, to produce the grid quality power.

2. A device according to claim one has a float guided by four pillars. (See fig 16). The pillars are constructed from deep below the ocean bed to withstand the force of the ocean waves during storms. Each float has two frames (one above and one below the float. See fig.3) which have wheels on its sides. The wheels slide along the four pillars and the float moves within the confines of the four pillars.

3. A device according to claim 1 has the height of the pillars about 10 feet to 15 feet more than the maximum height of the tide / wave that may arise during a cyclonic storm at the particular location.

4. A device according to claim 1 has the lower surface of the float in contact with the sea water. The float has inclined front and back surfaces. The inclined front surface faces the wave which lifts the float and the wave passes smoothly over the inclined back surface (See fig 3).

5. A device according to claim 1 has the float with two or more centrifugal pumps connected to a compressor, to pump out or pump in water into the float to get optimum required oscillation of the float as required during the periodic changing of the tides. (See fig. 3)

6. A device according to claim 1 has the float connected on either side of its upper surface, to two counter weights of more or less nearly one-third (1/3) of the total weight of the float. The two counter weights are connected by two ropes or by some other mechanical means to the float. (Fig 17)

7. A device according to claim 1 has the counter weights slide in two pairs of railings placed one each on either side of the four pillared structure. (Fig 17 & 18).

8. A device according to claim 1 has the center of the upper surface of the float connected by a hinge to the inner shaft of a hydraulic jack. This center point on the supper surface of the float corresponds to a point where the float can be suspended to stay in stable equilibrium. The size of the hydraulic jack is more than the twice the average amplitude of a regularly obtained waves there. (See fig 3)

9. A device according to claim 1 has the upper end of the hydraulic hack connected to a rod. The rod has on one side a bar with gear teeth which may extend on to the side of the socket of the hydraulic jack. (See fig. 4)

10. A device according to claim 1 has the gear – teeth of the bar engage a pinion gear on a horizontal shaft which is placed in the same direction as the waves incident on the float. (See fig 16).

11. A device according to claim 1 has the gear-teeth of the bar, engaging the pinion gear on the horizontal shaft and held in close proximity to the pinion gear by a grooved wheel placed behind the rod having the bar with gear-teeth. The outer collar of the bearings on either side of the shaft holding the grooved wheel are connected to the corresponding outer collar of bearings on the horizontal shaft on either side of the pinion gear by two metal bars. Thus the grooved wheel keeps the rod with bar teeth engaged with the pinion wheel on the horizontal shaft (See Fig 13)

12. A device according to claim 1 has the turbine type 1 with a horizontal shaft say 'one' (See fig. 5-H) has two free-wheels placed in reverse direction on the shaft. To give more strength, instead of two free-wheels, two sets of free-wheels may be used. The free wheels in each set are in the same direction and are connected to one another by sleeves.

13. A device according to claim 1, type 1 turbine wheel-gears of the same size are mounted on each free-wheel (or on the center free-wheel of each set of free-wheels. Henceforth one free-wheel or the set of free-wheels will be referred to as one free-wheel only for convenience.

14. A device according to claim 1, type 1 turbine has, one free-wheel gear of shaft 'one', (H) engaging another wheel gear on shaft 'two' (I). This shaft 'two' (I) also has another wheel-gear which is say, unengaged or (D) in figure 5.

15. A device according to claim 1, type 1 turbine has the second free-wheel gear of shaft 'one' (H), engaging another wheel gear on shaft 'three' (G). The shaft 'three' also has another wheel-gear say unengaged or (E). See figure 5.

16. A device according to claim 1, type 1 turbine has the 'two' unengaged wheel-gears (E & D) on shafts 'two' and 'three' (G& I), engage one another. See figure 5.

17. A device according to claim 1, type 1 turbine has the size of the wheel-gears on the three shafts such that they engage one another and all the three shafts moving on ball bearings move in Unison.

18. A device according to claim 1, type 1 turbine has a number of units one behind the other in a row. The shaft 'two' connects with the corresponding shaft 'two' of the next unit behind or the shaft 'three' connects with the corresponding shaft 'three' of the next unit behind.

19. A device according to claim 1, type 1 turbine, a fly-wheel (i) is placed on shaft 'two' or shaft 'three' (G or I) and also a motor (y) which runs on compressed air or fluid of a compressor to run the shaft in the same direction as that of its rotation. (See fig 16).

20. A device according to claim 1, type 2 turbine, the turbine has a pinion gear 'z' on a horizontal shaft (Say H). The rod with gear teeth on its side moves the pinion gear 'z'. (Fig 7).

21. A device according to claim 1, type 2 turbine, the turbine has two sets (Say C & D) of toothed wheels on horizontal shaft H. (Fig 7)

22. A device according to claim 1, type 2 turbine, the turbine has two compartments (Say A & B) and the two sets of toothed wheels occupy one compartment each. The toothed wheels may be of the same size or of different sizes in each set. (fig 7)

23. A device according to claim 1, type 2 turbine, in compartment A of the turbine there is a shaft I on which a set of free wheels E, all placed in the same direction of movement are present. (fig 7)

24. A device according to claim 1, type 2 turbine, the set of toothed wheels C on shaft H move the set of free-wheels E on shaft I with chain loops. (fig 7)

25. A device according to claim 1, type 2 turbine, the shaft I has a gear 'a' which moves the gear 'b' on shaft J, which in turn moves the gear 'c' on shaft G. (fig 7)

26. A device according to claim 1, type 2 turbine, in compartment B there is a shaft K on which are a set of free wheels F all placed in the same direction of movement (But in opposite direction to the movement of the free wheels E on the shaft I in the compartment A). (fig 7)

27. A device according to claim 1, type 2 turbine, chain loops connect and move the toothed wheels D on shaft H and the free wheels on shaft K. (Fig 7)

28. A device according to claim 1, type 2 turbine, the shaft K has a gear 'e' which moves the gear 'f' on shaft G. (Fig 7)

29. A device according to claim 1, type 2 turbine, the turbine has the fly-wheel i placed on the shaft G. (Fig 7)

30. A device according to claim 1, type 2 turbine, a number of units one behind the other in a row are placed on the ocean near the shore. The shaft G of one unit connects with the shaft G of the next unit behind. (Fig 21)

31. A device according to claim 1, type 2 turbine, the turbine has a fly wheel 'i' placed on the shaft G and also a motor 'y' which runs on compressed air or fluid of a compressor to run the shaft G, in the same direction as that of its rotation. (Fig 16)

32. A device according to claim 1, type 3 turbine, the turbine has the rod with the gear teeth on it's side move a pinion gear 'z' of the turbine. The pinion gear 'z' is on the horizontal shaft H. (Fig 9)

33. A device according to claim 1, type 3 turbine, the turbine has two sets (Say C & D) of toothed wheels on horizontal shaft H. The toothed wheels in a set may be of the same size or of different sizes. (Fig 9)

34. A device according to claim 1, type 3 turbine, the turbine has a shaft G on which are a set of free-wheels (Say E) all placed in the same direction of movement. (Fig 9)

35. A device according to claim 1, type 3 turbine, the set of toothed wheels C on shaft H move the set of free-wheels E on shaft G with chain loops. (Fig 9)

36. A device according to claim 1, type 3 turbine, the turbine has a shaft K on which are a set of free-wheels F all placed in the same direction of movement (But in opposite direction to the movement of free wheels E on the shaft G). (Fig 9)

37. A device according to claim 1, type 3 turbine, the set of toothed wheels D on shaft H move the set of free-wheels F on shaft K through chain loops. (Fig 9)

38. A device according to claim 1, type 3 turbine, the shaft K of the turbine has a gear 'e' which moves the gear 'f' on shaft G. (Fig 9)

39. A device according to claim 1, type 3 turbine, the turbine has a fly-wheel 'i' placed on shaft G. (Fig 9)

40. A device according to claim 1, type 3 turbine, a number of units are placed one behind the other on the ocean near the shore. The shaft G of the type 3

turbine of one unit connects with the shaft G of the type 3 turbine on another unit behind and in front. Thus all units are connected to one another. (Fig 21)

41. A device according to claim 1, type 3 turbine, on shaft G, are placed, the fly-wheel 'i' and also a motor 'y' which runs on compressed air or fluid of a compressor to run the shaft G in the same direction as that of it's rotation. (Fig 16)

42. A device according to claim 1 has, a fly wheel with a brake system on it, to slow its speed if needed. The fly wheel also has two pulley grooves on it to run pulley belts. (See fig 14).

43. A device according to claim1, when only one unit is used to produce power, one pulley groove (J) on the fly wheel may be used through a pulley belt (P) and counter to get the required speed to run a generator. Alternatively, a generator may be run through a gear box (o) to get the required speed and connected to the same shaft as that of the fly-wheel. (See fig 14).

44. A device according to claim 1 has, the second pulley grove (k) on the fly-wheel connected to the motor to power a compressor by a pulley belt (Q) (See fig 14).

45. A device according to claim 1 has

a. The brake system on the fly wheel connected to the compressor tank and operated if needed,
b. The motor Y on the fly-wheel shaft connected to the compressor tank and operated if needed,
c. The centrifugal pumps placed on the float, connected to the compressor tank and operated if needed,
d. The hydraulic jack connected to the compressor tank, and operated if needed,

through a computer or a mechanical system to co-ordinate and regulate the speed of the shaft needed to run the generator to get grid quality power.

46. A device according to claim 1 has, a number of units one behind the other in a row, So, the same incident wave after lifting the first float, lifts the second float behind and the third float behind etc., till all its energy is used in lifting the floats. The floats may be placed one immediately behind the other or at some distance between them. (Fig 21)

47. A device according to claim has, a number of rows placed side by side along the coast in the sea. (See fig 20).

48. A device according to claim 1 has, the shafts of the last units in all the rows connected by 45° bevelled gears to a long horizontal shaft placed at right angles (to the shafts). Thus all the power of the rows of the units is transferred to the horizontally placed shaft. This horizontal shaft is connected to an electric generator through a gear-box (if needed), to produce grid quality power. (Fig 21)

49. A device for harnessing the coastal waves of the ocean as substantially described with reference to drawings.

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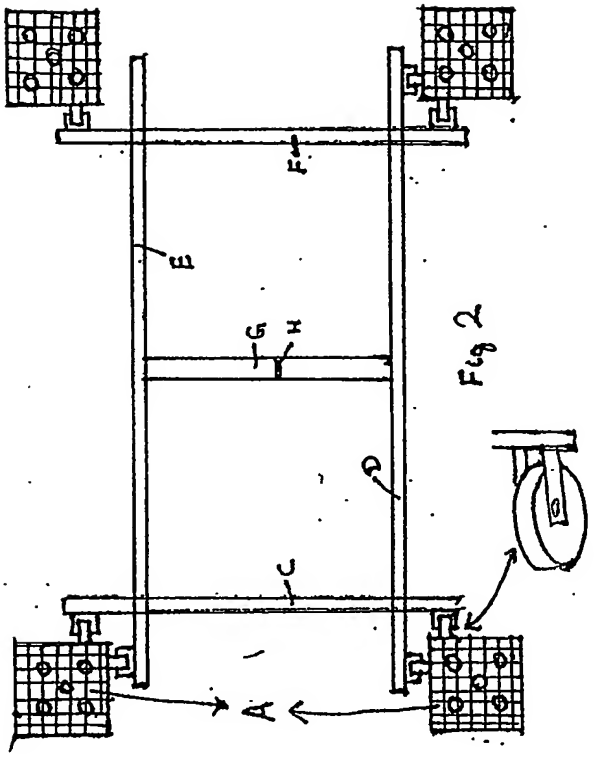


Fig 2

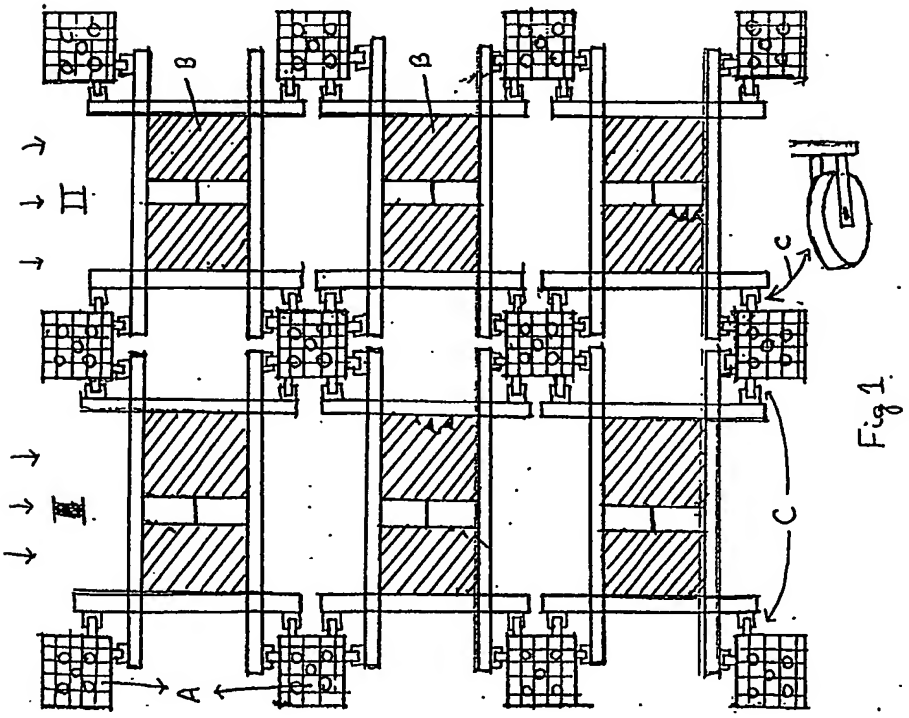
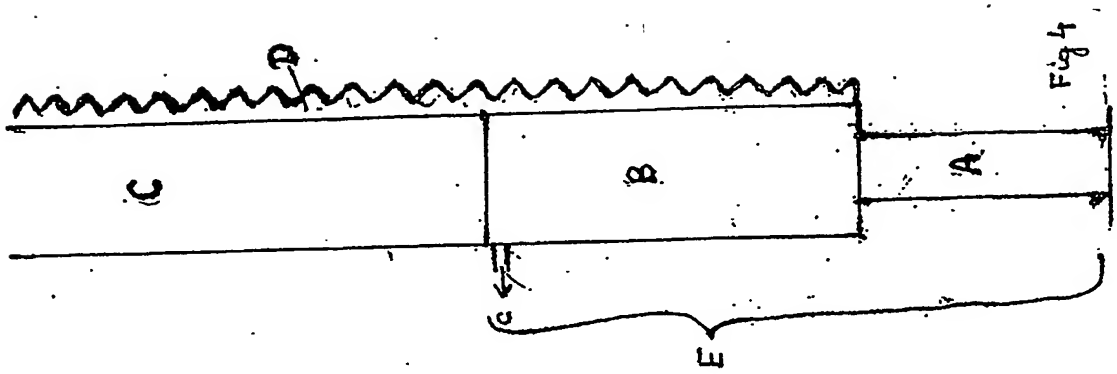


Fig 1



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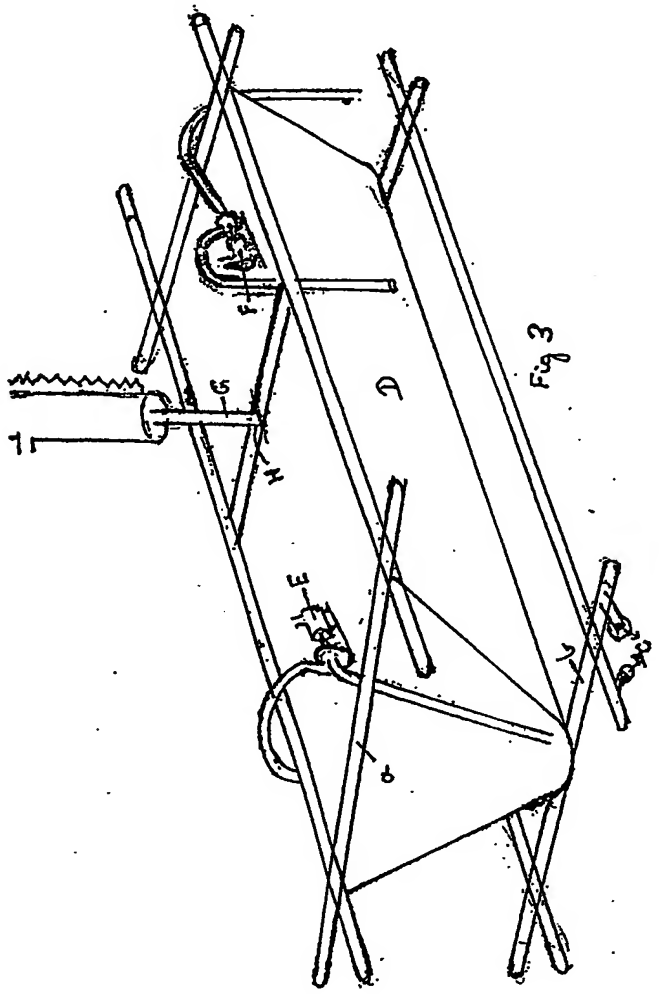


Fig 3

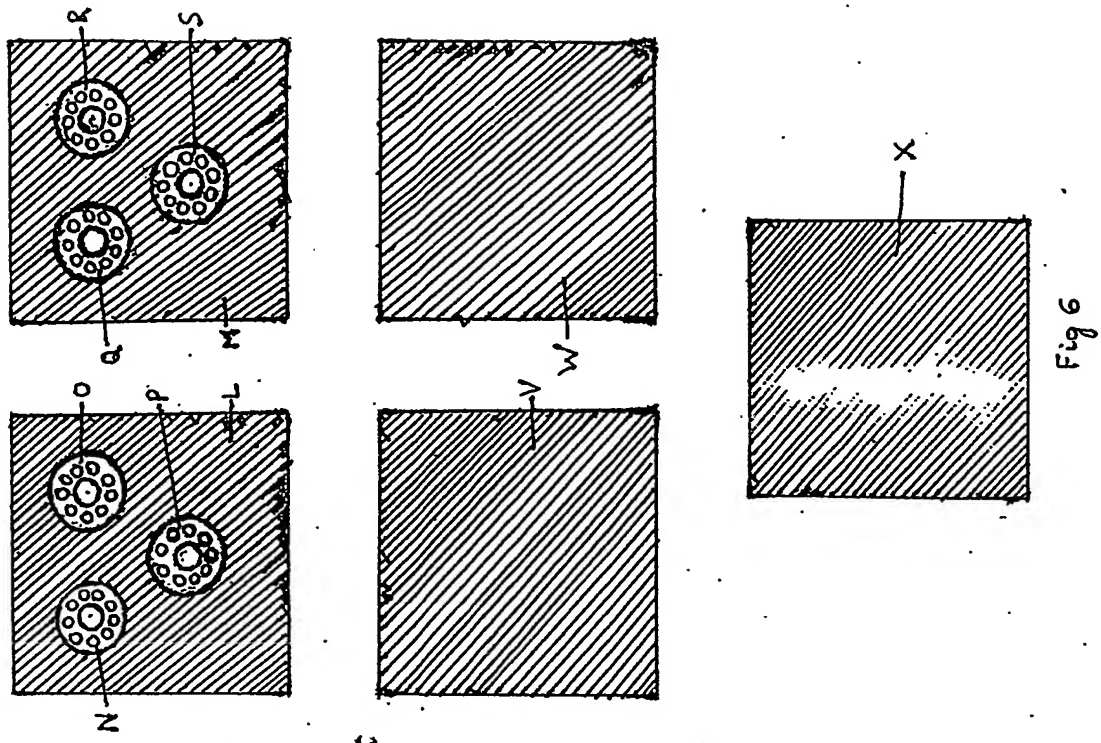


Fig 6

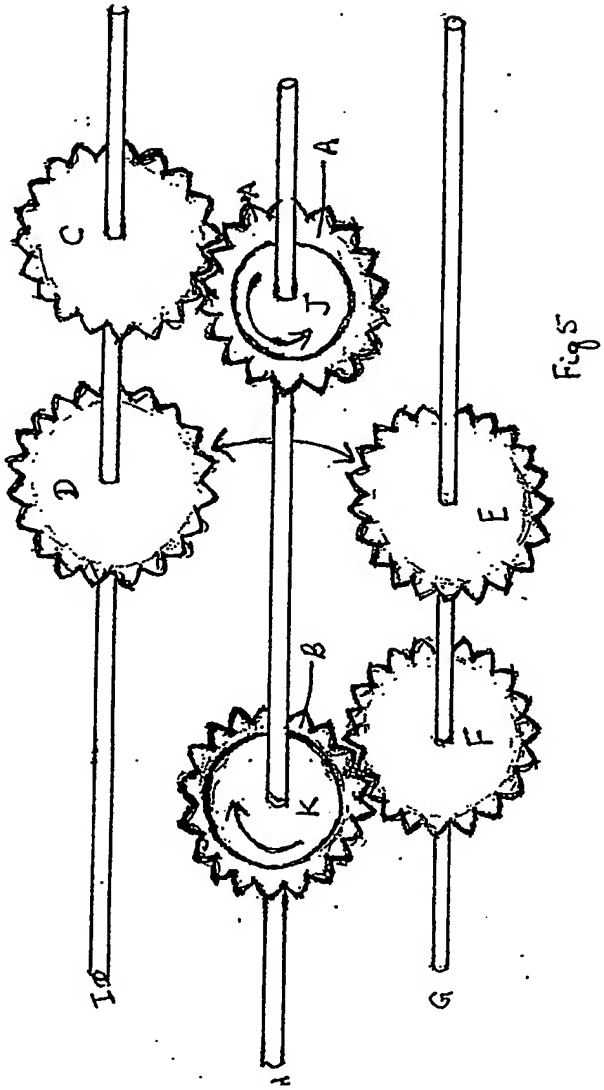
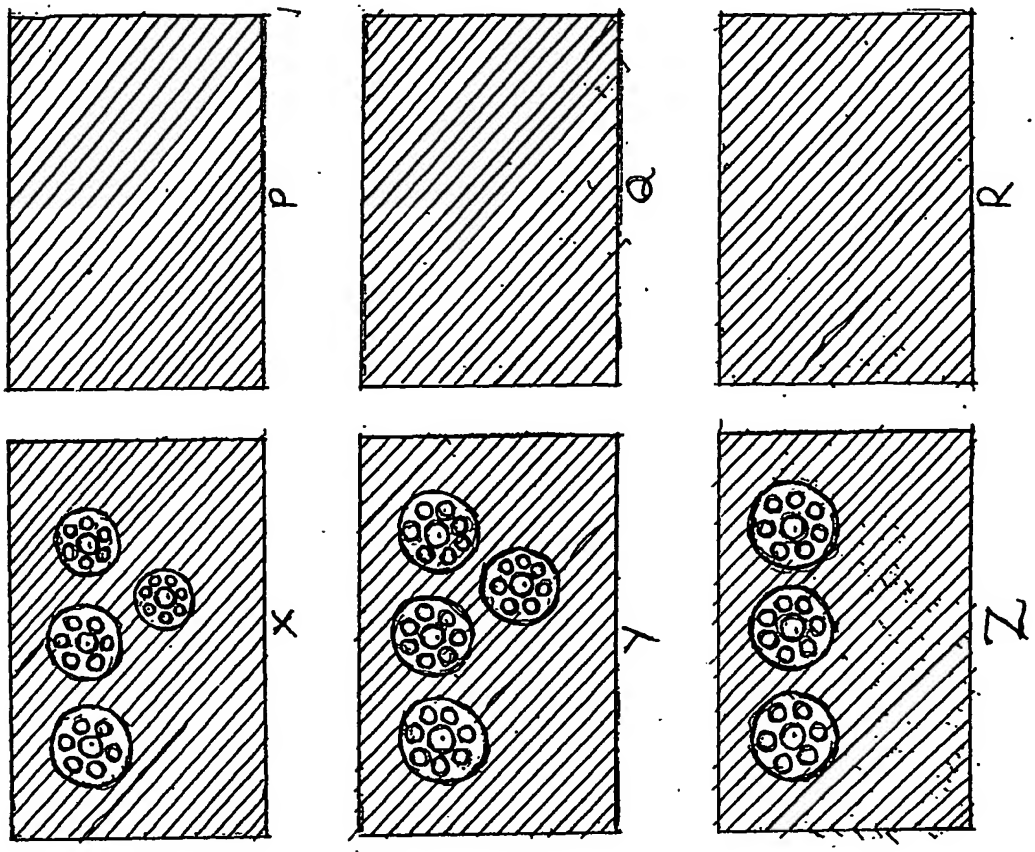


Fig 5



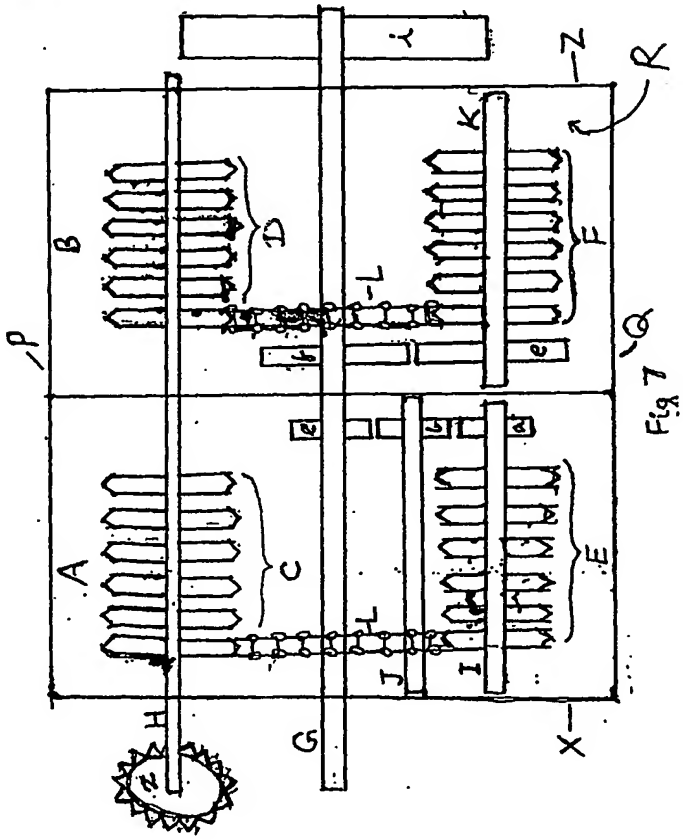


Fig 7

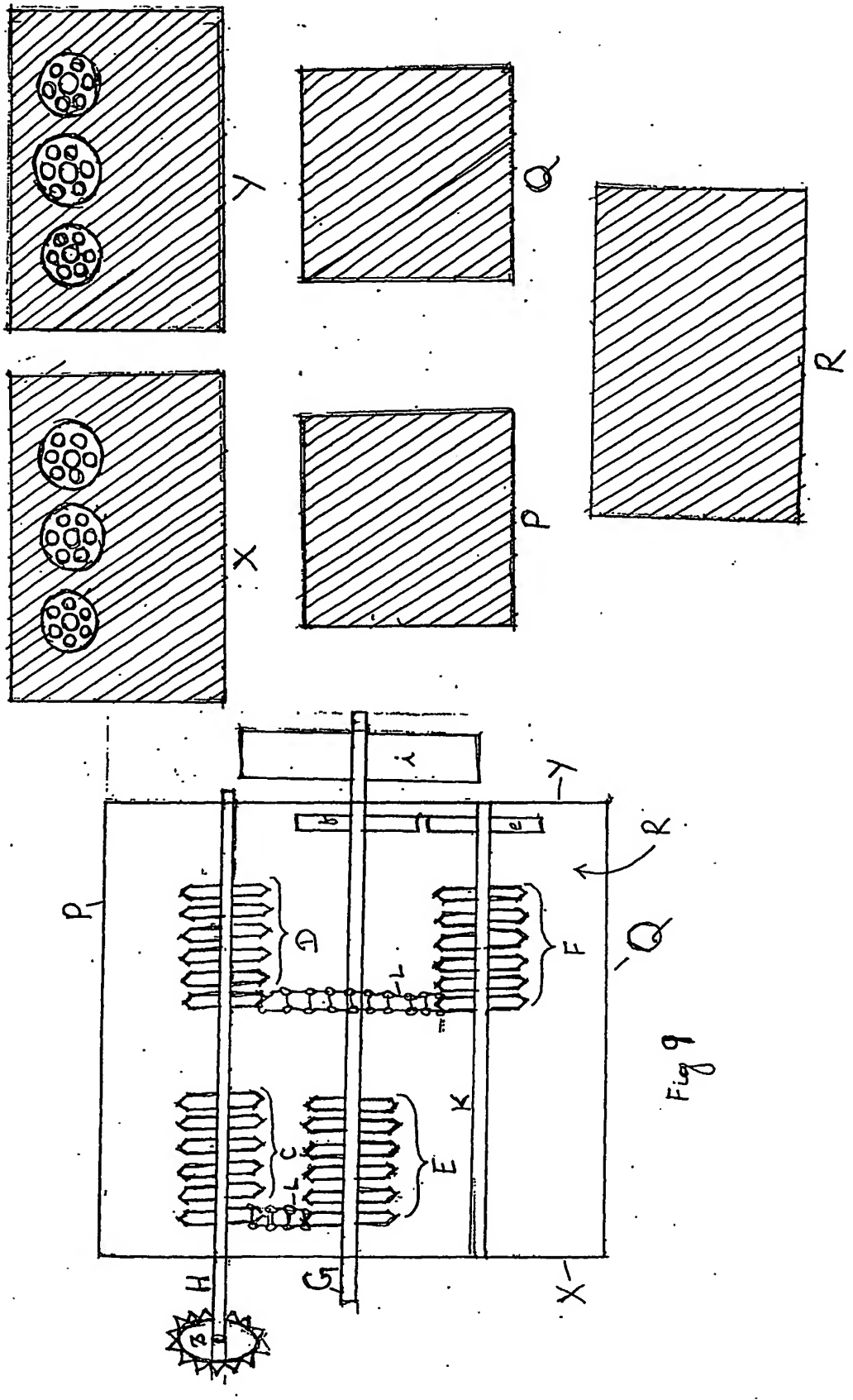
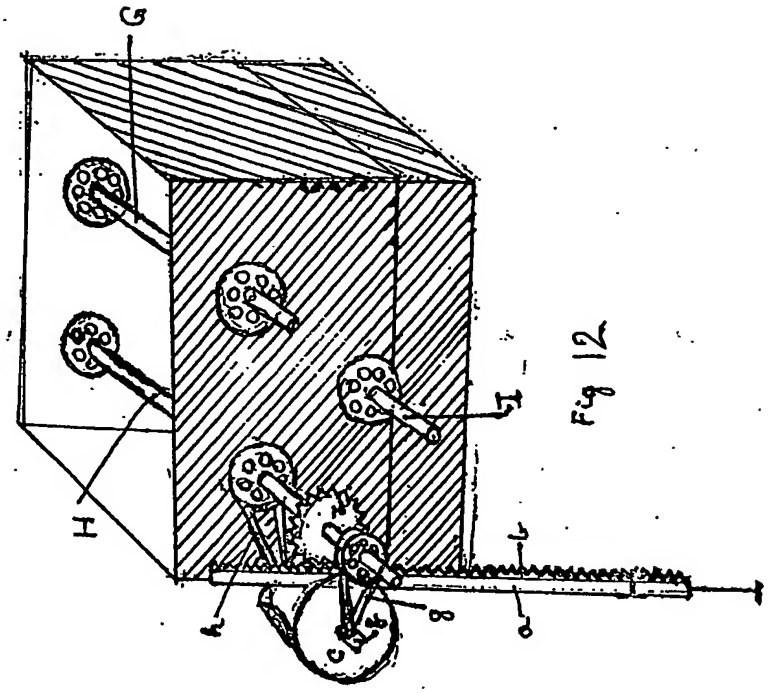


Fig 9



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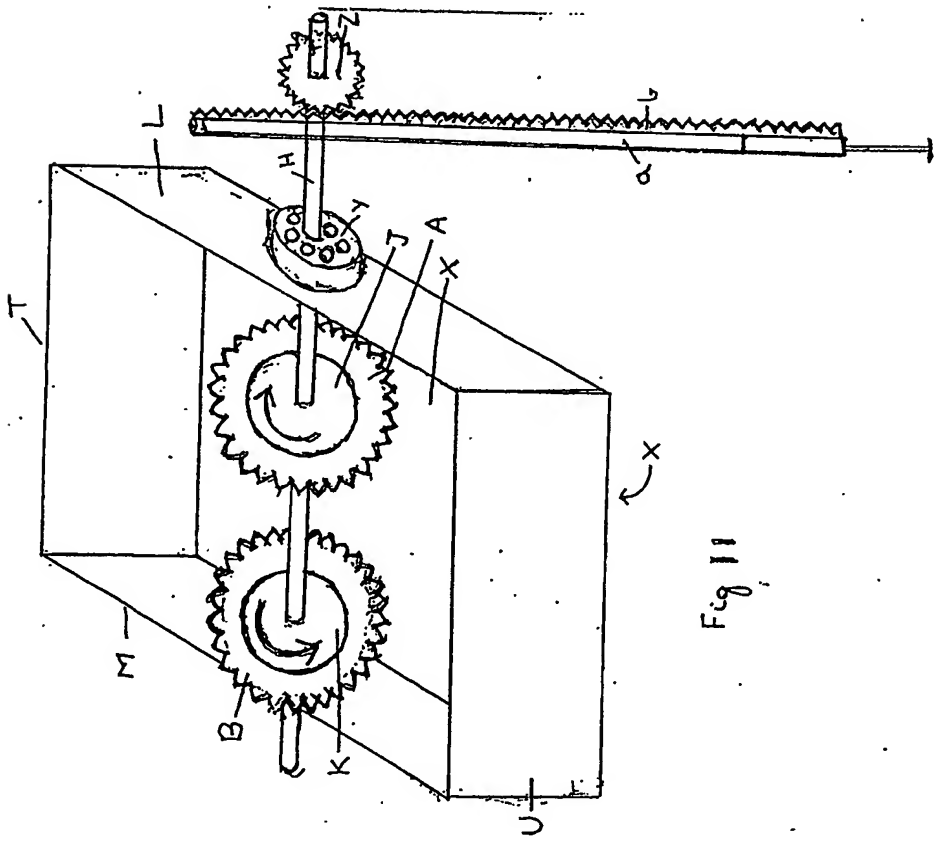
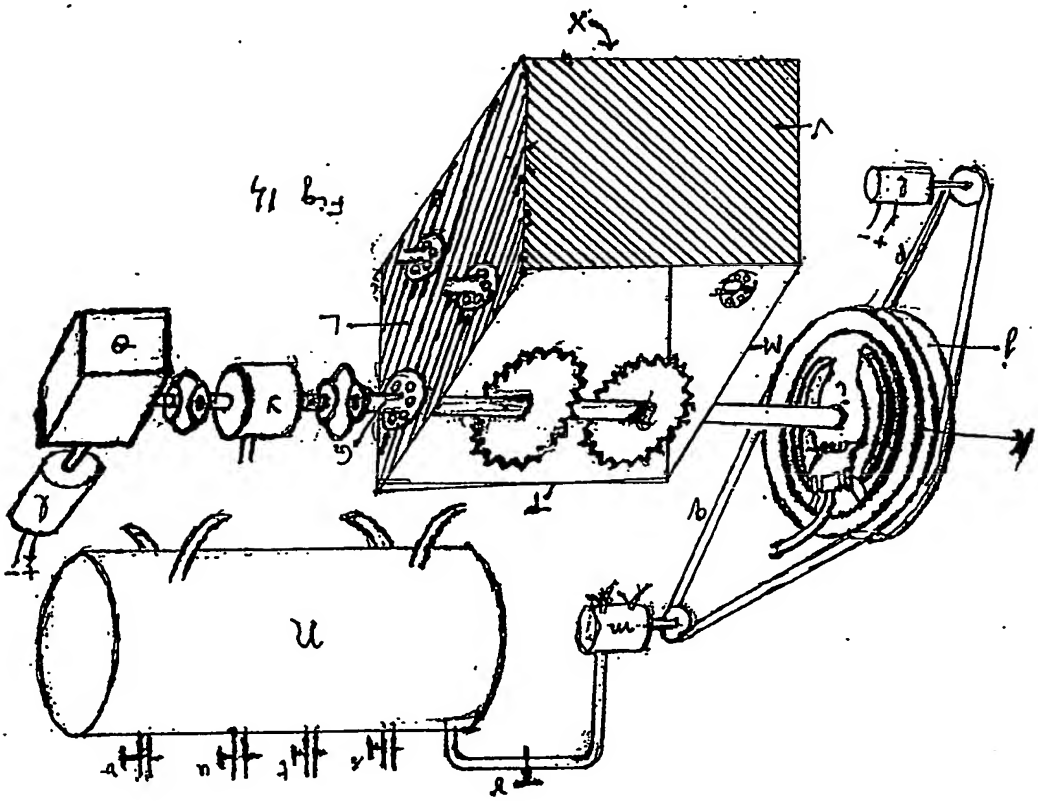


Fig 11



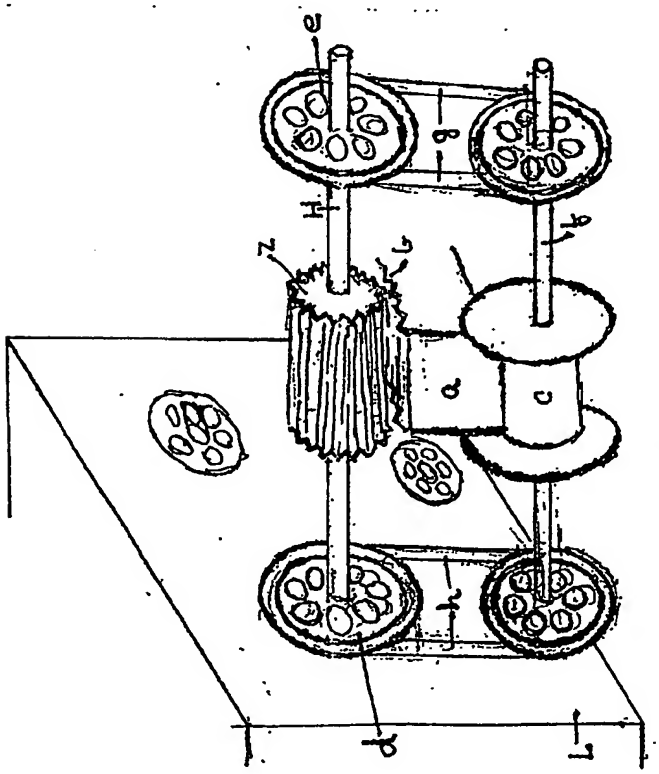


Fig 13

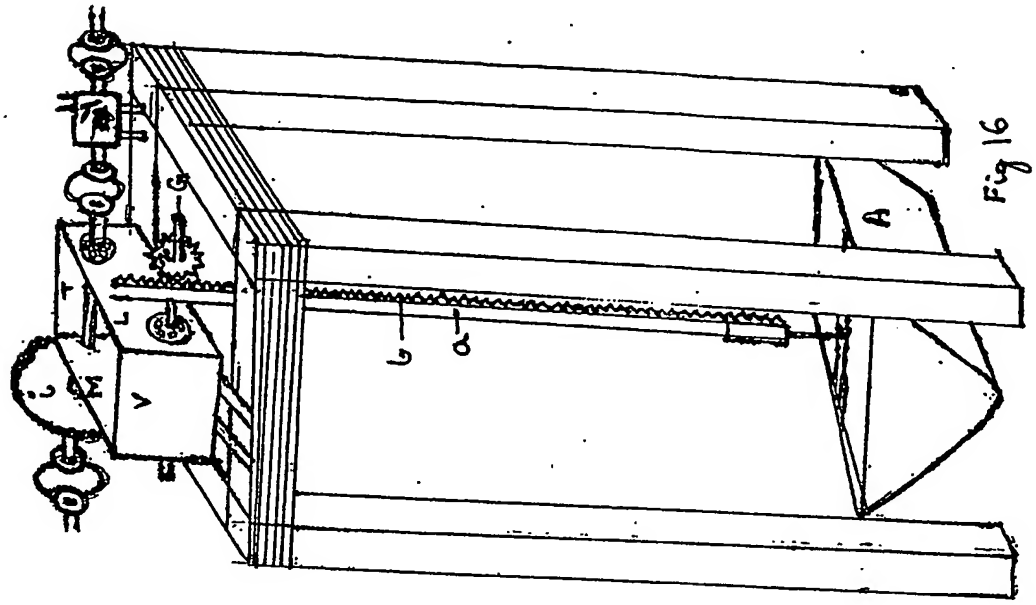


Fig 16

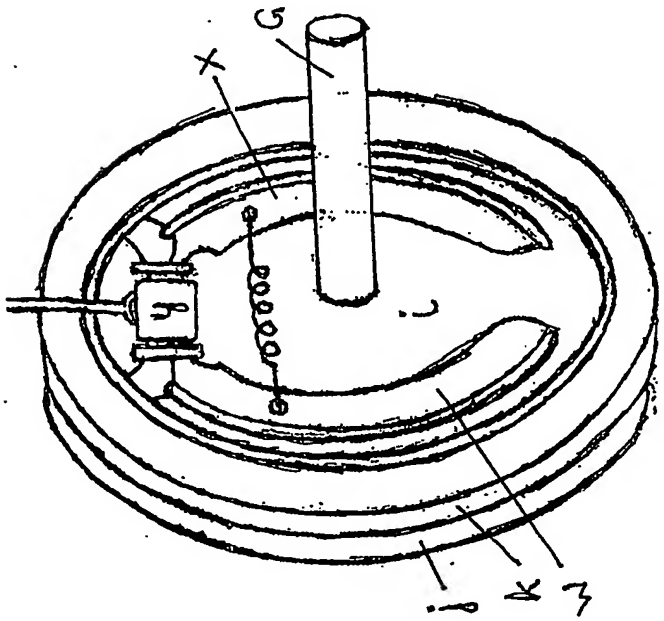


Fig 15

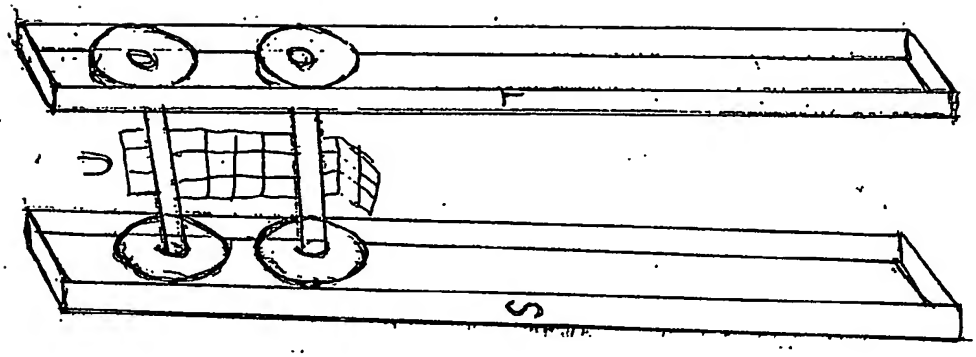


Fig 18

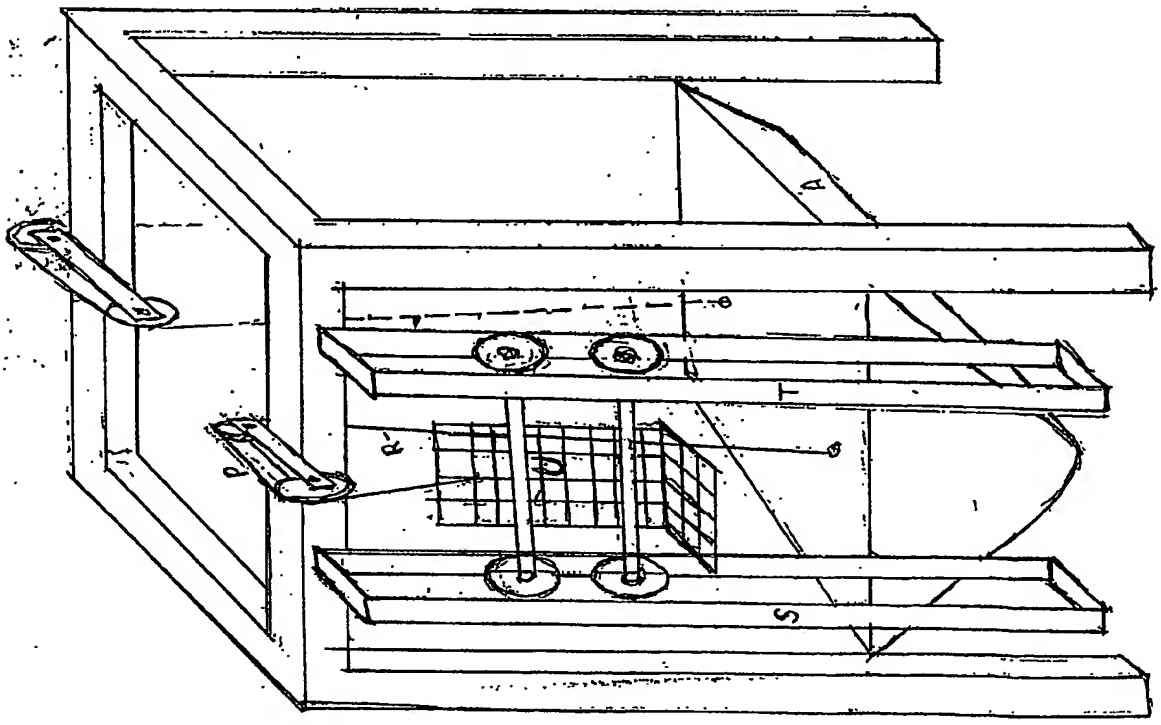


Fig 17

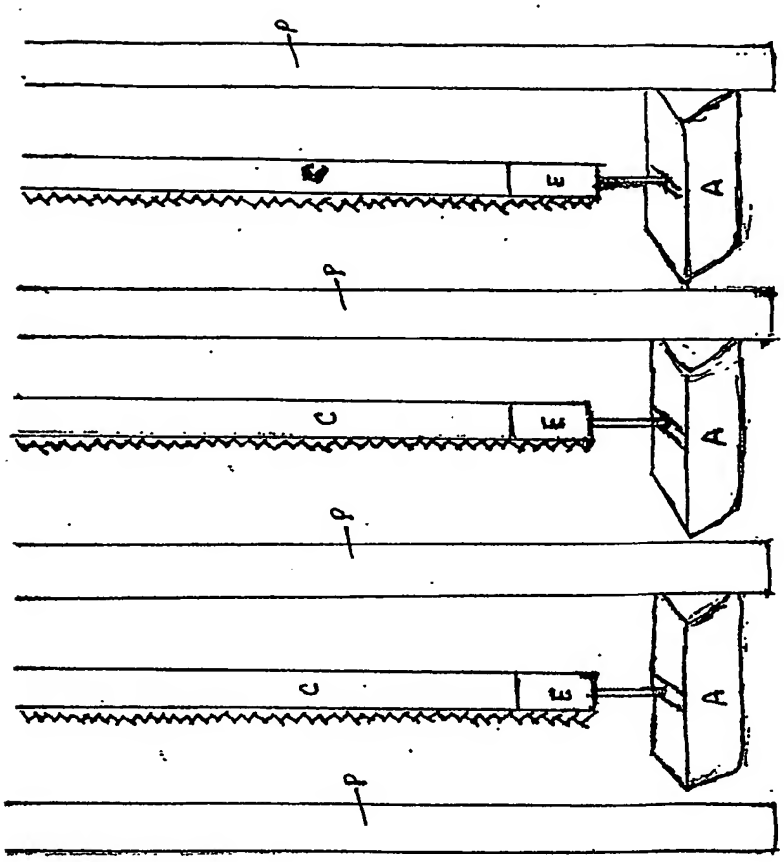


Fig 20

10/11

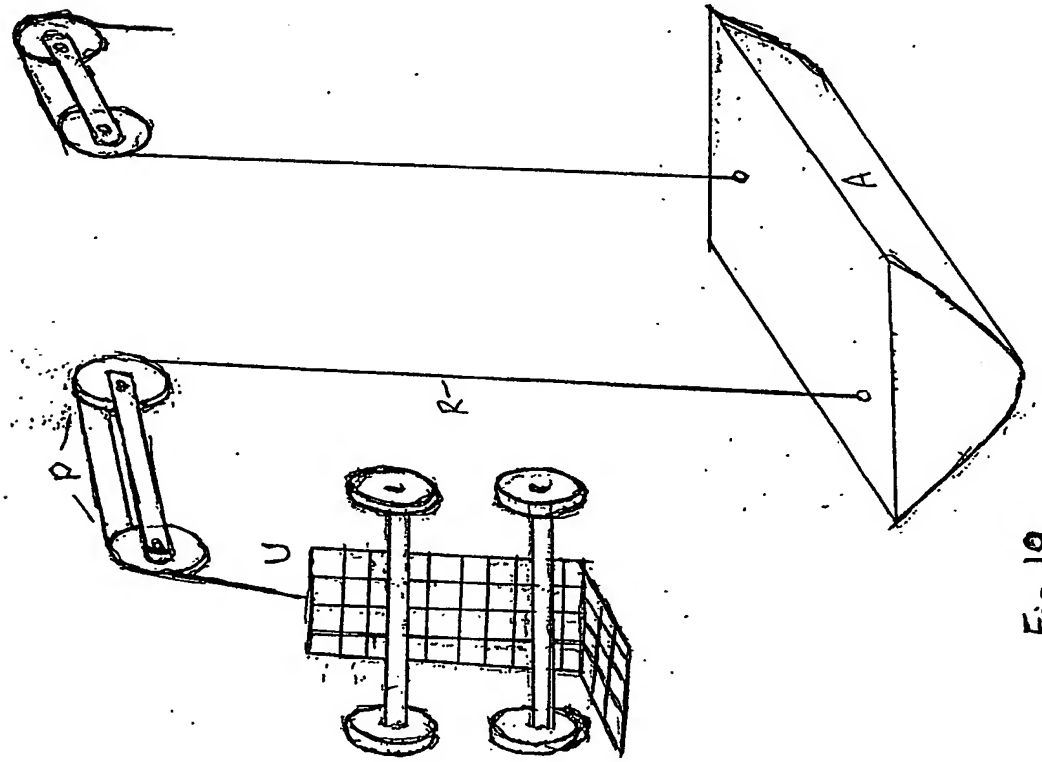


Fig 19

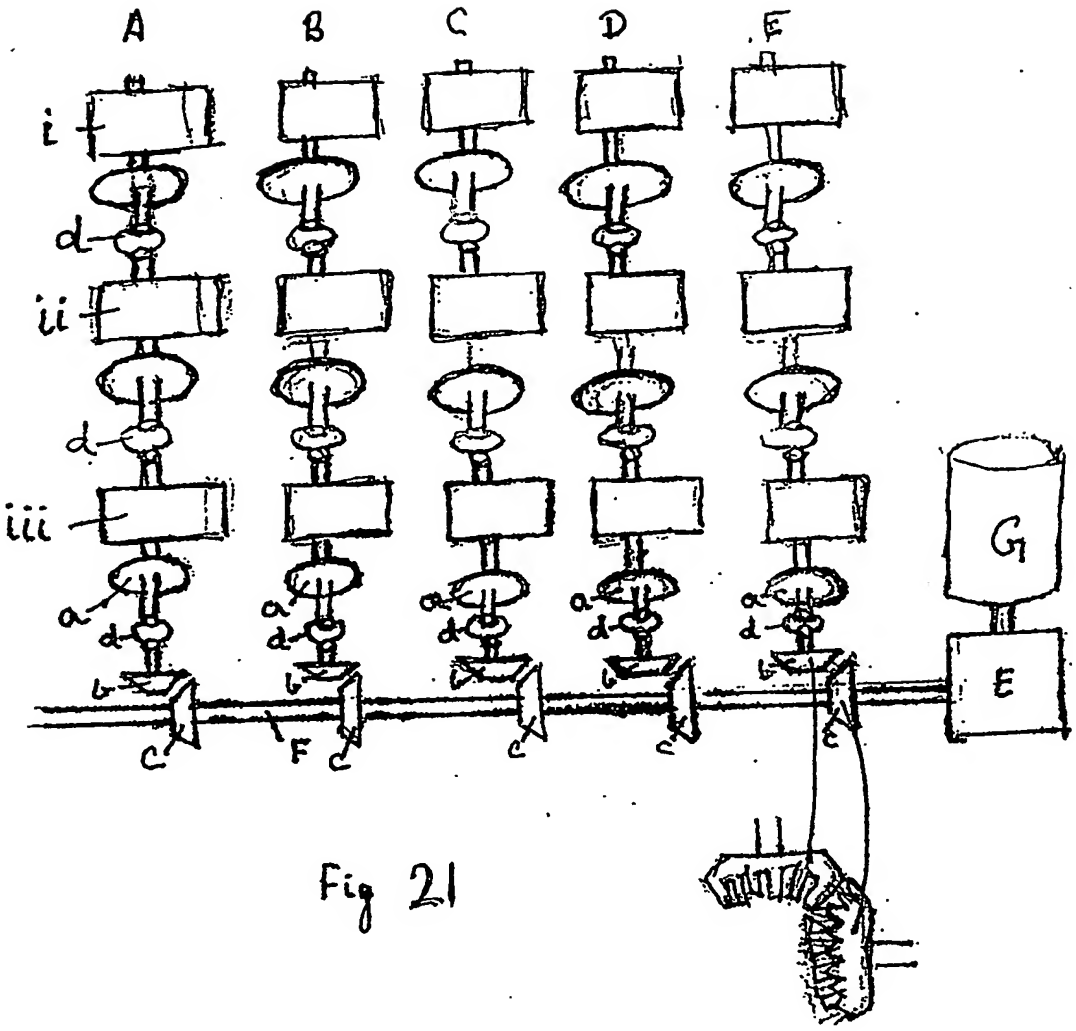


Fig 21

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IN 03/00036-0

CLASSIFICATION OF SUBJECT MATTER

IPC[7]: F03B 13/12

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC[7]: F03B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI, EPODOC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 30 43 751 A1 (MAYER) 3 June 1982 (03.06.82) *the whole document*	1,2,11-49
X	US 4 184 336 A (LAMBERTI) 22 January 1980 (22.01.80) *the whole document*	1,2,11-49
X	US 4 627 240 A (HOLMES) 9 December 1986 (09.12.86) *Fig. 1-3; Ansprüche 1-11*	1,2,44-49
X	US 4 108 578 A (COREY) 22 August 1978 (22.08.78) *Fig. 1,3*	1

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
„A" document defining the general state of the art which is not considered to be of particular relevance
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„O" document referring to an oral disclosure, use, exhibition or other means
„P" document published prior to the international filing date but later than the priority date claimed
„T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
„X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
„Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
„&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
12 June 2003 (12.06.2003)	25 June 2003 (25.06.2003)
Name and mailing adress of the ISA/AT Austrian Patent Office Dresdner Straße 87, A-1200 Vienna Facsimile No. 1/53424/535	Authorized officer RIEDER W. Telephone No. 1/53424/366

Form PCT/ISA/210 (second sheet) (July 1998)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/IN 03/00036-0

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE A1 3043751	03-06-1982	none	
US A 4108578	22-08-1978	none	
US A 4184336	22-01-1980	none	
US A 4627240	09-12-1986	none	